Department of Environmental Quality

To protect, conserve and enhance the quality of Wyoming's environment for the benefit of current and future generations.

Matthew H. Mead, Governor

Todd Parfitt, Director

March 5, 2015

Mr. Chuck Cornell
Senior Regulatory Lead
Jonah Energy LLC
707 17th Street, Suite 2700
Denver, CO 80202

Permit No. **MD-16985**

Dear Mr. Cornell:

The Division of Air Quality of the Wyoming Department of Environmental Quality has completed final review of Jonah Energy LLC's application to conduct well blowdown and venting activities in the Concentrated Development Area described as locations within Carbon, Fremont, Lincoln, Natrona, Sweetwater, Sublette and Uinta Counties, Wyoming. The proposed permit includes requirements to conduct well blowdown and venting activities using Best Management Practices (BMP) associated with manual and automated blowdown/venting episodes associated with liquids unloading, wellbore depressurization in preparation for maintenance or repair, hydrate clearing, emergency operations and equipment depressurization, and to monitor, maintain records, and report emissions from the well blowdown and venting activities.

Following this agency's proposed approval of the request as published January 29, 2015, and in accordance with Chapter 6, Section 2(m) of the Wyoming Air Quality Standards and Regulations, the public was afforded a thirty (30) day period in which to submit comments concerning the proposed new source, and an opportunity for a public hearing. No comments were received during the public comment period. Therefore, on the basis of the information provided to us, approval to conduct well blowdown and venting activities in the Concentrated Development Area as described in the application is hereby granted pursuant to Chapter 6, Section 2 of the regulations with the following conditions:

1. That authorized representatives of the Division of Air Quality be given permission to enter and inspect any property, premise or place on or at which an air pollution source is located or is being constructed or installed for the purpose of investigating actual or potential sources of air pollution and for determining compliance or non-compliance with any rules, standards, permits or orders.

2. That all substantive commitments and descriptions set forth in the application for this permit, unless superseded by a specific condition of this permit, are incorporated herein by this reference and are enforceable as conditions of this permit.

3. All notifications, reports, and correspondence required by this permit shall be submitted to the Oil & Gas Permitting Engineer, DEQ/AQD, 152 North Durbin Street, Suite 100 Casper, WY 82601 and a copy shall be submitted to the appropriate Air Quality District Engineer.

   District 2 Engineer (Carbon and Natrona Counties), 152 North Durbin Street, Suite 100, Casper, WY 82601.

   District 4 Engineer (Fremont and Lincoln Counties), 510 Meadowview Drive, Lander, WY 82520.

   District 5 Engineer (Sweetwater, Sublette and Uinta Counties), 510 Meadowview Drive, Lander, WY 82520.

4. Emissions of volatile organic compounds (VOC) and hazardous air pollutants (HAP) resulting from episodes of manual and automatic blowdown and venting of hydrocarbon fluids (liquids and gas) associated with liquids unloading, well purging, wellbore depressurization, hydrate clearing, emergency operations, equipment depressurization, etc., shall be minimized to the extent practicable.

5. During manual blowdown and venting episodes, personnel shall remain on site for the duration of the episode to ensure minimal gas venting occurs by ending the episode as soon as possible once the intended purpose for the episode has been accomplished. The requirement for the personnel to remain on site does not apply to automated blowdown and venting episodes and does not apply to any episode where remaining on site might be considered a safety hazard.

6. For all manual and automatic blowdown and venting episodes the following shall be recorded.

   A. Facility name and legal location (Section, Township, Range, County) and associated Air Quality Permit number;
   B. Date, duration, start and end time;
   C. Reason for episode, i.e. unload well by venting well tubing to blowdown tank, relieve annulus pressure, depressurize well for downhole repair, etc.;
   D. Measure(s) taken to ensure emissions were minimized to the extent practical;
   E. Name of person(s) remaining on site for the duration of manual blowdown and venting episode;
   F. Summary of total volumes of hydrocarbon fluids (barrels of oil, condensate, and water and MCF of gas) recovered and vented;
   G. Estimated pounds of VOC and HAP emissions associated with the vapors vented to the atmosphere.

7. VOC and HAP emission estimates required under Condition 6(G) shall be determined using the spreadsheets illustrated in Appendix A. The spreadsheets are available for download from the DEQ/AQD website or may be obtained upon request. An emission estimation method other than that provided by the Division may be used upon approval.

8. Within nine (9) months after the date of issuance of this permit, a summary of the information recorded under Condition 6 shall be submitted to the Division. The data required under Condition 6 shall be collected for a minimum of six (6) months after the date of permit issuance and shall include all gas analyses used as sources for the input information in the spreadsheets required under Condition 7.

9. The Division will reopen and revise this permit, as necessary, to add or delete requirements should the Division determine that:

   A. The practical application of the terms and conditions of the permit are unfeasible or fail to achieve the intent of the permit, or;

   B. The monitoring, recordkeeping, notification or reporting requirements are inadequate to assure compliance with applicable requirements.

10. All records required under this permit shall be kept for a period of at least five (5) years and shall be made available to the Division upon request.

It must be noted that this approval does not relieve you of your obligation to comply with all applicable county, state, and federal standards, regulations or ordinances. Special attention must be given to Chapter 6, Section 2 of the Wyoming Air Quality Standards and Regulations, which details the requirements for compliance with Condition 3. Any appeal of this permit as a final action of the Department must be made to the Environmental Quality Council within sixty (60) days of permit issuance per Section 16, Chapter I, General Rules of Practice and Procedure, Department of Environmental Quality.

If we may be of further assistance to you, please feel free to contact this office.

Sincerely,

Steven A. Dietrich
Administrator
Air Quality Division

Todd Parfitt
Director
Dept. of Environmental Quality

cc: Tony Hoyt
Chris Hanify
Greg Meeker

SD/hb

Appendix A

Blowdown/Venting Spreadsheet

Spreadsheet for calculating emissions associated with gas vented from ANNULUS when there is an associated pressure drawdown ($P_1 > P_2$).

	INPUT		CALCULATED		
Gas HAP Content (wt%)	6				
Gas VOC Content (wt%)	15				
Gas Compressibility (Z)*	0.98				
Gas Molecular Weight	17.74	lb/lbmol			
Universal Gas Constant (R)	10.732	ft^3 psi/°R lb-mol			
Starting Pressure (P_1)	1500	psig	1512	psia	
Ending Pressure (P_2)	0	psig	12	psia	
Starting Temperature (T_1)	55	°F	515	°R	
Ending Temperature (T_2)	55	°F	515	°R	
Tubing Outside Diameter (OD)	2.875	in	Starting Gas Density (ρ_1)	4.9521	lb/ft³	$\rho_1=(P_1*MW)/R*T_1*Z$
Casing Inside Diameter (ID)	3.92	in	Ending Gas Density (ρ_2)	0.0393	lb/ft³	$\rho_2=(P_2*MW)/R*T_2*Z$
Annulus Length (AL)	500	ft		4.9128	lb/ft³	$\rho_1-\rho_2$
				0.0387	ft^3/ft	Annular Volume per Linear Foot (AV)
Gas Release				95	lb	Pounds of Gas per Linear Foot = ($\rho_1 - \rho_2$) * (AL) * (AV)
Gas Release				2,032	SCF	Conversion to SCF = (Gas Release (lb)) * (379 SCF/lb-mol) / (molecular wt of gas (lb/lb-mol))
VOC Release				14	lb	VOC release = (Gas Release (lb)) * (Gas VOC Content / 100)
HAP Release				6	lb	HAP release = (Gas Release (lb)) * (Gas HAP Content / 100)

Tubing Sizes			Casing Sizes		
nom.	OD inches	ID inches	nom.	OD inches	ID inches
2 3/8	2.375	1.94	4 1/2	4.5	3.92
2 7/8	2.875	2.26	4 3/4	4.75	4.2
3 1/2	3.5	2.76	5	5	4.41
			5 1/2	5.5	4.82

* For the purposes of this spreadsheet, assume the starting Z factor = the ending Z factor.

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Spreadsheet for calculating emissions associated with gas vented from tubing or casing when there is an associated pressure drawdown ($P_1 > P_2$)

	INPUT		CALCULATED		
Gas VOC Content (wt%)	50				
Gas HAP Content (wt%)	6				
Gas Compressibility (Z)*	0.95				
Gas Molecular Weight	17.74	lb/lbmol			
Universal Gas Constant (R)	10.732	ft^3 psi/°R lb-mol			
Starting Pressure (P_1)	500	psig	512	psia	
Starting Temperature (T_1)	600	°F	1060	°R	
Ending Pressure (P_2)	600	psig	612	psia	
Ending Temperature (T_2)	55	°F	515	°R	
Tubing or Casing Inside Diameter (ID)	1.875	in	Starting Gas Density (ρ_1)	0.8405	lb/ft³	$\rho_2=(P_1*MW)/R*T_1*Z$
Tubing/Casing Length (TL)	15000	ft	Ending Gas Density (ρ_2)	2.0677	lb/ft³	$\rho_2=(P_2*MW)/R*T_2*Z$
				-1.2273	lb/ft³	$\rho_1-\rho_2$
				0.0192	ft^3/ft	Volume per Linear Foot (TV)
			Gas Release	-353	lb	Release = ($\rho_1-\rho_2$) * (TL) * (TV)
			Gas Release	-7541	SCF	Conversion to SCF = (Gas Release (lb)) * (379 SCF/lb-mol) / (molecular wt of gas (lb/lb-mol))
			VOC Release	-176	lb	VOC release = (Gas Release (lb)) * (Gas VOC Content / 100)
			HAP Release	-21	lb	HAP release = (Gas Release (lb)) * (Gas HAP Content / 100)

Tubing Sizes			Casing Sizes		
nom.	OD inches	ID inches	nom.	OD inches	ID inches
2 3/8	2.375	1.94	4 1/2	4.5	3.92
2 7/8	2.875	2.26	4 3/4	4.75	4.2
3 1/2	3.5	2.76	5	5	4.41
			5 1/2	5.5	4.82

* For purposes of these calculations assume starting Z = ending Z.

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Spreadsheet for calculating blowdown/venting emissions from tubing, casing or annulus when there is minimal or no pressure differential during the event ($P_1 = P_2$)

	INPUT		CALCULATED	
Fill in the five parameters below.	↓			
Average Daily Gas Production Rate	1	MSCFD		
Vented Gas VOC Content	50	wt%		
Vented Gas HAP Content	35	wt%		
Vented Gas Molecular Weight	20	lb/lb-mol		
Blowdown Duration	120	minutes		
Total Gas Emitted			0.083	MSCF
VOC Emissions			2.2	lbs
HAP Emissions			1.5	lbs

Air Quality

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